



**STRATEGY
RESEARCH
PROJECT**

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TECHNOLOGICAL TRENDS AND DEFENSE CHOICES

BY

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**LIEUTENANT COLONEL JIM WARNER
United States Army**

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Jim Warner
Lieutenant Colonel, U.S. Army
Senior Service College Fellow
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Technological Trends and Defense Choices

A Research Paper by LTC Jim Warner

Abstract

This paper challenges the popular notion that the revolution in military affairs will bring a realignment in which air and sea forces are dominant and land forces less relevant. Many analysts have called for reductions in Army land forces to pay for "leap ahead" modernization of air and sea platforms to assure full exploitation of the promise of technology. These analysts miss several key points. The nature of the military technological revolution is to provide all parties the capability to acquire and destroy targets effectively at far greater ranges. This revolution most affects surface navies, which have no speed or stealth. Naval forces are faced with spiraling costs which will continue to rise exponentially with efforts to assure the survivability of the fleet. In the end the fleet may not be survivable against asymmetric strategies at any cost. Marine expeditionary forces are likewise the most expensive, slowest and most vulnerable of expeditionary forces. Manned aircraft are next most affected. Their speed advantage is rapidly fading and soon missiles exceed the limits of human endurance now. Aircraft can only survive by our ability to make them vanish into thin air. Stealth against old radars has been less effective than advertised and for more expensive. Costs of stealth will be increasingly expensive if technically sustainable. Further the effectiveness of remote sensor acquisition and was exaggerated in Desert Storm. The pursuit of victory through air power alone will prove unaffordable if not unachievable. Ground forces will be affected as well, but have more practical and less expensive options to survive and continue to pursue their objectives. They can change doctrine, structure, tactics and platforms to remain viable and dominant in the theater where political objectives lie. The technological trends indicate a reallocation, but not from ground forces to air and sea forces. The reallocation should be away from surface naval and strategic bombing forces and toward balanced air-land expeditionary forces, capable of mobility, dispersion and decision.

With the government focused on balancing the budget, the buying power of the Defense Department continues to decline. Because of this decline, the nation's military must invest its funding in those systems and structures with the greatest potential to contribute to US security objectives. Recently, among defense experts a consensus has emerged that if a choice must be made in systems and structure, defense investment should focus on air and sea forces at the expense of land forces. This paper disagrees with the popular consensus and argues that the maximum security returns on future defense investments will come from balanced land and tactical air forces at the expense of maritime and strategic bombing forces. This argument is based on a reconsideration of the current debates on the impacts of technological advancements on the future of war and the military.

There continues to be a great deal of discussion about the implications of expected technological trends for the US Defense Department. Many policy makers and analysts espouse the view that a "revolution in military affairs" will usher the country into a future where long-range precision-strike weaponry will dominate our military strategy and obviate the need for any other capability. These analysts advocate major shifts in defense investment strategy calling for ground force reductions to go toward the recapitalization of the remaining structure.¹ This new consensus seeks to reallocate defense investment to improve precision guided munitions for air and maritime power projection forces. The consensus also holds that advances in military technology will provide new capital-intensive air and maritime global expeditionary forces, and that these forces will achieve higher levels of effectiveness with reduced risk of casualties.

This approach is neither visionary nor realistic; it may, however, be counterproductive. Such an approach ignores the current and inevitable future challenges for projecting naval power ashore as well as the inherent limitations of a near exclusive reliance on air power. The new trends in technology have differing effects on the capabilities and vulnerabilities of land, sea, and air forces. Naval forces have likely reached a discernible limit in their ability to both utilize new offensive technologies in achieving their missions and simultaneously defending themselves against them. New surveillance, precision strike, and mobility technologies make ships only slightly more capable, while greatly enhancing the capabilities to attack ships from air, sea or ground.

A careful analysis of the differential effects of technology indicates that the defense balance should move toward a reduction in the naval component of the future force. Responding to increasingly sophisticated threats will fall to inherently more

flexible ground and tactical air forces supported by strategic transport. It is fallacious to believe that air power alone will be decisive in future wars. Those advocating ground force reductions to strengthen other capabilities have yet to make a compelling case on the grounds of technological yields. In fact, technological trends point toward resurgence of the importance of land forces while sea forces, and some air forces are marginalized by asymmetric strategies. The strategic implications for investment and force structure are simple, clear and impolitic. If stark budgetary choices must be made, defense funds should be invested in balanced land and tactical air forces at the expense of maritime and strategic bombing forces.

The essence of the military technology revolution is the development of unprecedented ability to see and destroy anything at any distance. The problem is how to avoid detection and continue fighting. The lethality grows so rapidly that survival will increasingly be a function of stealth rather than armor protection. Thus the problem for the services is how to make forces indistinguishable from the medium in which they operate. Failing that, they must commit to ever increasing costs of protecting detectable platforms from every conceivable weapon which in the end may prove futile. The surface navy cannot hide, and will be forced to bear unsustainable and exponential rises in the costs of countermeasures. Stealth offers aircraft protection from today's unsophisticated radars - at extraordinary prices. This provides a viable short-term solution, but leads to long-term bankruptcy or failure. As detection capabilities follow the incentive to advance, the only medium that provides an opportunity for combatants to become indistinguishable is ground.

Land surface complexities offer ground combatants opportunities to challenge target acquisition systems in ways planes and ships never can. Sensitivities to collateral damage add to requirements for target discrimination that exist only when targeting ground forces. This creates extreme requirements for even the most advanced remote surveillance systems. The combination of these factors will ensure that land forces will continue to adapt, survive and fight in pursuit of war aims. War cannot be won without defeating those forces. That defeat will have to come on the ground- from superior ground forces with superior tactical air forces and strategic lift. Thus technology ultimately favors land, then air, then sea forces. To pursue air and sea forces at the expense of land forces is a sure path to excess, not success.

Historical Perspective

All elements of the Armed Forces have unique strengths and weaknesses. Sound decisions on force structure must determine the proper mix of forces and capabilities for future missions. Decisions on future force structures are necessarily long-term, as they often take a decade or more to fully implement. Further, it takes two decades to train and develop the leadership required for tactical organizations. Similarly, the time horizon of systems development from investment to implementation is often measured in decades. Force structure and technology investments require up to two decades to mature into field capabilities. American success in the Gulf War was a product of 1960s technology, developed in the 1970s, fielded in the 1980s and used by soldiers, sailors, airmen, and marines in the 1990s. The longer-term strategic and technological trends are critical to both defense investment and force structure decisions. Such trends are critical but fortunately clear. Some historical perspective is useful in this examination.

The current military departments evolved from a variety of strategic and special requirements. The two central requirements are to win wars and to project American power. Early in this century the relationship was simple. Army ground forces were for continental defense and maritime forces were for power projection. If a major land war was to be fought, the Army could be mobilized for defense, even in the most dire of circumstances.

This relationship held true until the World Wars. Even then the US remained insulated from the fighting. That insulation provided the months or years of mobilization required to project land power. In World War II aircraft became available on a scale sufficient to support both strategic attack and strategic projection of land forces. After Normandy, the Army and majority of the Air Force formed a team that could prosecute conventional conflict and achieve decisive results in war. While the potential for power projection through strategic lift was available in subsequent decades, focus on European defense and turf battles over funding and resources prevented the full development. Early efforts to coordinate such projection included the establishment of Joint Commands such as STRICOM, the U.S. Readiness Command, and the Rapid Deployment Joint Task Force. But the lift capability to support these organizations was not fully developed. The primary focus of land power was in forward deployment or reinforcement of Europe.

Defense planners placed strategic lift behind strategic attack and air superiority pitted against the established cold war threat. The Navy and Marine Corps remained an expeditionary force for the projection of US power worldwide. The critical decision for US policy makers continues to be the determination of the proper mix of these forces to achieve the nation's security goals with the least cost in blood and treasure.

Theoretically, air and land forces could have achieved decisive results wherever they were employed. Almost as important, their deployment demonstrated both US commitment and resolve. This afforded the United States an unparalleled diplomatic position. Unfortunately, early air forces required extensive land bases and had limited range, and ground forces required extensive logistics and were committed only when positioned. The expensive logistics of land and air forces required policy makers to station these limited resources carefully to support vital national interests. Accordingly, air and land forces came to be seen as strategically limited due in part to their heavier lift and logistical requirements. Much of the land and tactical air force structure was strategically fixed by the defense requirements of the Cold War contributing mightily to such a perception. These two factors interacted to create a heavier force, focused on the defense of Western Europe, with limited applicability to distant crises.

The most consistent challenge to this relationship has been the continuing assertion that air power had evolved to become decisive as an independent arm in an assertion that was proven wrong in World War II, Korea, Vietnam, and in the Gulf War. The Gulf War Air Power Survey concluded that air power broke the enemy's will to resist but was not on its own decisive.² Historically, the Army and Air Force maintained limited contingency forces, while Naval and Marine forces provided the United States with additional response capability for operations short of war.

Land forces, with appropriate air forces have historically been decisive in war. The Navy and Marine forces have always provided strategic mobility and sea control. By maintaining naval presence in the oceanic regions, these forces could respond to any crisis in a few days or weeks, depending on warning time. Such rapid response enhanced US capability to defuse crises in peripheral regions such as Cuba, Lebanon, the Dominican Republic, and other remote regions. Further, maritime forces could reinforce existing land and air capabilities in coastal regions. Naval and Marine forces, however, lacked the power or sustainability required to prevail in more than minor crises or beyond a major continent's coastal areas. Strategic mobility of sea forces also had a political disadvantage. Operating from the sea provided only transient diplomatic leverage, often

limited to the periphery of strategic territory.

A proper balance of service capabilities has always been required to achieve US security objectives and this requirement will continue; yet the key question is how the new balance will differ from the old. All the armed services have applied emerging technologies to reduce their vulnerabilities and exploit their strengths, but the proportion of such application varies significantly by service. The United States should invest defense funds to achieve the maximum increase in the capability of Joint Forces to achieve the military objectives assigned by the President and Secretary of Defense. New technologies are changing the inherent strengths and limitations of traditional defense organizations and the relative returns on technology investments for different structures as well. These new realities should change our thinking about the proper balance of defense investment and force structure.

Effects of Technology on Land, Sea and Air Forces

Futurists are nearly unanimous in predicting the advent of smaller, more lethal, more capable weapons and formations. The reasons are clear. Range, lethality and precision of missiles and other weapons systems increases steadily. The new lethality is a function of the ability of weapon systems to employ fewer, more sophisticated components to destroy more targets in less time and at longer ranges. New systems continue to proliferate across more nations. An examination of the effects of these trends shows that the greatest return in terms of increased combat capability is likely to come from investment in land forces, tactical air forces, and the strategic lift required to give the combination global reach.

The impact of technological integration on land forces is clear, increasing the power of smaller land formations and reducing their bulk. The heavy forces of the Cold War era were too heavy to transport and light forces too light to prevail in a world where even small nations possessed heavy tank forces and some aircraft. New waves of technological innovations and the end of the Cold War have combined to make heavy forces lighter and light forces more lethal. The Army's recent fielding of the first portable, "fire-and-forget" Javelin antitank weapon illustrates the effects of technology and the lethality afforded to light forces. Efforts to reduce vulnerability will lead to doctrinal innovations to achieve massed effects of dispersed forces. Current trends also indicate increased operational tempo and reduced logistical requirements for more

flexible, sustainable operating forces. Such innovations will further increase the capabilities of land forces as well as their strategic mobility. A host of recent U.S. Army and USMC initiatives pursue the massing of fires rather than of forces. Several new works show the potential for adapting ground forces to achieve dominance. For example, Douglas MacGregor's Breaking the Phalanx: A New Design For Landpower illustrates how ground forces could be reorganized to dominate a technologically advanced future war.³ Such efforts will continue to increase the lethality, tactical mobility and strategic mobility of ground forces.

A dramatic increase in strategic mobility is now evident and is certain to accelerate as land forces modernize. The end of the Cold War produced an extraordinary enhancement in strategic mobility. The force structure which was strategically fixed in or toward Europe for 40 years is now available for projection of US power. This has already been demonstrated in Desert Storm and, more recently, in Bosnia. Thus the strengths of these forces -- their ability to achieve decisive victory -- are reinforced as limitations in mobility are overcome.

Innovations in air transport will complement these trends with more capable lift. USAF BG Ronald T. Kadish heralds the contribution of the C-17 this way: "The C-17 brings capability that no single airlifter has been able to provide to the armed forces of the United States. It can carry large, outsized cargo of the modern Army, transport that equipment international distances, and land on short, austere airfields near the battle area."⁴

Secretary of the Air Force Donald B. Rice declared in "Global Reach, Global Power," that land-based air forces, with enhanced air refueling and extended range, are now truly global.⁵ The US aerospace capability will continue to command this realm, or at least deny it to adversaries in all future conflicts. The trends in lethality and accuracy of precision-guided munitions are obvious, even if oversold. Clearly, areas where reconnaissance can be performed and targets can be identified will be subject to air or missile attack. Fixed sites will be at greatest risk of such attack. Air forces will have increasing ability to attack targets from longer ranges if the challenges of acquisition and target discrimination can be overcome. However, advancing technology will produce increasingly effective air defense systems as well. This will force aircraft to employ greater standoff, and longer ranges will, reduce effectiveness against an active foe, particularly against mobile targets.

An important result of these trends is the increasing utility of theater tactical air power and the declining utility of strategic air power. Tactical air becomes cheaper and more effective in performing tasks formerly within the domain of strategic bombers except, possibly, the delivery of nuclear weapons. In an exhaustive study of the use of air power to coerce compliance with political objectives, Robert Pape, writing for Cornell Studies in Securities Affairs, concluded:

In fact the advocates of strategic bombing have it exactly backward. PGMs (Precision Guided Munitions) have done nothing to enhance strategic air power. Punishment, risk, and decapitation strategies had little merit before PGMs and they have little merit now. Denial remains the most effective coercive air strategy and PGMs have further increased the superiority of theater air over strategic bombing.⁶

Other futurists are convinced that the future of warfare lies in entirely in the realm of air and space. But the challenges of terrain and weather will continue, as will the evolution of ground and space-based and air defenses. Mid sized powers will use and exploit high endurance, unmanned aerial vehicles and most countries will benefit from satellite intelligence. Commercial development of space-based observation assets is so advanced that even the US military finds it advantageous to buy satellite photography. This is not a new development. Today thousands of satellites orbit overhead with dramatic growth in commercial entries. The US military purchased satellite imagery from commercial sources during the Persian Gulf War, including hundreds of valuable images from French SPOT Satellites. Air Force MG Kenneth Israel, director of the Defense Airborne Reconnaissance Office (DARO) told reporters: "If the industry is going to create a lot more products derived from commercial open sources; we want to be in a position to access them." According to Israel 1,700 commercial satellites will be launched in the coming decade and the Pentagon wants to use them. What is new is that anyone can buy satellite imagery anywhere for between one and two thousand dollars.⁷ Therefore, the U.S. will not be alone in capitalizing on the new transparency. Many nations buy considerable amounts of such imagery rather than building and launching their own capacity. The Gulf War advantage of asymmetric information may evolve to mutual transparency. Commercial developments will further the advancement of military air, air defense forces and space capabilities worldwide. According to MG Israel: " here is the big picture: We are now entering the age of transparency. That is something we ought to recognize and capitalize on."⁸ We will not be alone in that pursuit.

Future US forces will have the capabilities to defeat today's countermeasures, but will be forced to alter their methods to defend against tomorrow's. Currently the US attempts to protect its own platforms from the new transparency with stealth technologies. In simple terms the survival of America's combat aircraft depend on our ability to make planes disappear into thin air -- not just from the eye, but radar and instruments as well. Clear evidence of the costs of doing so are seen in the so called "black budget" for classified, predominantly Air Force programs. Jane's Defence Weekly estimates that DoD's share of the classified budget has grown in recent years. One report estimated that so called black programs account for 41% of procurement and 34% of Research and Development for the US Air Force.⁹ These are indicative of the rising costs of the pursuit of stealthy air platforms against increasing access to surveillance technology and the new transparency.

The Difference Battlespace Makes

The effects of military technology depend mostly on the character of the battle space involved. In the professional literature, much attention is devoted to the effects of lethality on massed land armies. With the Gulf War as background, a great support exists for reducing investment in large, heavy land formations because of their vulnerabilities to new weaponry. The complexities of ground warfare, however, offer land combatants many options to be less observable or more lethal. Land forces can adapt organizations, formations and doctrine, and can attack the forces and systems that threaten them. Both friendly and unfriendly land armies are sure to do so over time. Disappearing in the sky is possible but much more costly.

Air Force Chief of Staff Gen. Ronald R. Fogelman said "in the first quarter of the 21st century we will have the ability to track and target anything of significance that is moving or is fixed on the surface of the earth in near real time."¹⁰ Such a claim ignores one immutable fact. At any level of technology it is easier to achieve, to acquire, to discriminate between friend and foe, and to destroy targets in the sky than on the ground. It is simply easier to tell the difference between planes and air than to sort out the complex configuration of people and the territory they inhabit. It is also cheaper. This reality became clear in April of 1997, when the USAF lost radar tracking of one of its own A-10 aircraft in Colorado. "The Air Force launched a massive search, making more than 200 flights by dozens of aircraft, ranging from U-2 spyplanes to Army helicopters," Search operations cost \$800,000 and finally found the wreckage after twenty days.¹¹ This was in peacetime, in the US, and not far from a several major US Air Force Bases.

The Gulf War provides a combat example to illustrate the point. When Stealthy F-117 fighters flew over Baghdad at night, Iraqi ground-based radar tracked the F-117s, and sent fighter aircraft to intercept. Iraqi fighter planes could not locate the stealthy F-117s at night and returned empty handed.¹² This illustrates the inherent disadvantage of size and weight constrained aircraft systems compared to ground based systems with no such constraints.

Air dominance is a source of great pride for the United States, and a powerful advantage to joint forces in conflict. We should recognize, however, that attempting to dominate the ground from the air represents a commitment to outspend and out develop any potential adversary. Such a strategy is particularly susceptible to the law of diminishing marginal returns or to asymmetric strategies. Examples of asymmetric strategies include the strategy of denial. In simple terms, the adversary says "If I can't have it, nobody will." An adversary pursuing denial would forgo development and procurement of aircraft for air dominance in favor of intensive investment in air defense. Such strategies concede classic goals while planning to make the US pay dearly for what success it achieves, and prevent US success on land. As such, pursuit of goals exclusively through air dominance seems an unwise foundation for defense strategy and structure.

Naval forces face an even more daunting reality. Finding large surface ships on the ocean is the easiest task of all. Accordingly, surface ships face major challenges to their survivability with fewer, far more expensive options to assure their survival. Indeed, their survival increasingly depends on disproportionate spending for sophisticated countermeasures. Submarines by their nature are more survivable and are likely to increase in importance relative to surface combatants. As in the air, the costs of combating an adversary bent on denial of the seas is likely to be high.

In the final analysis, the impact of technology is to enable all combatants to "see" farther and to more effectively destroy what they see. Accordingly, future combatants will be required to be either more remote from the battlefield or less detectable if they are to survive. Remoteness impairs effectiveness and invites countermeasures. Stealth through technology seems to require a blank check.

Every weapons system in history has spawned countermeasures. The end of a system's dominance in battle is near when the cost of protecting the weapon system increases to the point where the costs of self protection become dominant and degrade its

offensive capability. George and Meredith Friedman of the Center for Geopolitical Studies and authors of the acclaimed book, book The Future of War, discuss the evolution of long term evolution of weapons systems. They describe the life cycle of a system from its inception through dominance to "senility." The historical lessons from evolution of weapons systems are as follows:

1. In the beginning, a new system may appear frail and flimsy, as early aircraft did fighting against dominant battleships.

2. A promising weapons system begins with "the simple purity of the offensive and culminates in a weapons system overwhelmed by its own defensive measures."

3. "The weapon system reaches its limit of usefulness when the defensive measures necessary for its survival destroy the weapon's cost effectiveness. This was the case with Goliath's armor and may be the case with stealth technology, today's armor."

4. Forces least likely to recognize the onset of senility are those that have been most successful. "Successful wars breed the illusion that particular technologies will always be successful. This illusion merges with the interests of the successful command structure, which uses the perception of technical infallibility to create a sense of its own superiority and even invincibility..."

5. At its high point, just before disaster, the last generation's technology appears invincible.

6. Successor technologies share a common trait, a simplistic return to the relentless offensive.

7. "Parasitization" is always underway. The life of a weapons system is determined by the ability to design countermeasures and their pace of deployment.

8. A successful military is one that can constantly overthrow old weapons and doctrine and integrate new ideas and personnel without social upheaval. No military has been able to do this permanently.

In short, a weapon system appears, dominates, and is sustained longest by the power with the greatest resources. Others turn to innovation of newer concepts and systems before the ascent of these systems to dominance.¹³ "Senile" systems slowly fade, draining the national treasuries of powers that hang on to these systems for too long

until they suddenly discover that the system is no longer economically viable. In as many cases as not, the senile system and the power that clings to it are defeated in battle by a seemingly inferior force.¹⁴ The Friedmans point out that the aircraft carrier, airplane and tank will all become senile at some point. The key to successful defense planning is to recognize that point and adjust doctrine, planning, and strategies accordingly.

The Friedmans point to several systems that seem furthest along the path to senility:

The finest contemporary example is the B-2 Stealth Bomber, which, in order to carry a destructive load of about twenty-five tons, needs defensive measures costing over \$1 billion each. Placing a billion dollar plane at risk to drop twenty-five tons of explosives implies that the target must be destroyed and that no other means of achieving this end is possible — two unlikely propositions.¹⁵

In specific terms: modern aircraft carriers have between twenty-four and thirty-six strike aircraft on board—more in some specialized cases. Some sixty other planes, a cruiser, one or two destroyers, and one or two attack submarines, along with supply vessels, shore facilities, and so forth, all exist so that a handful of aircraft can each drop eight to twelve tons of ordnance at a time. As threats against the aircraft carrier rise, and the cost of keeping it operational soars, its offensive capability will tend toward zero. At that point it will become senile.¹⁶

Other data on the aircraft carrier support this conclusion. The platforms most vulnerable to advancing missile technologies are surface ships. They are arguably the largest, slowest and most vulnerable to evolving offensive capabilities. Thus they consume the largest proportion of resources for their defense. Navies are thus forced to achieve every possible technological leap and apply it to their defense to assure their own survival. That the United States alone can afford a carrier based surface Navy is further indication of such a force's advancing senility. Most estimates place the cost of naval aircraft structures at many multiples of the cost of similar capabilities from land-based tactical air forces.

In the final analysis, technological increases in lethality will be felt most harshly in sea, then in the air, and, last of all, on land. Surface ships are forced to defend against every new capability but they cannot get smaller or faster. The Aegis Cruiser has evolved to protect the fleet from missile threats. Indeed, the continued operation of the Aegis Cruiser is less a sign of aircraft carriers growing complexity, than that the carrier itself is at enormous risk.¹⁷ The cost of that defense is high and sure to rise. According to Frank

Gaffney, director of the Center for Security Policy, "The United States has invested nearly \$50 billion in these assets that presently provide robust air defense for carrier battle groups and other naval and Marine combat elements." Gaffney goes on to highlight continuing vulnerability and to argue for increased spending on maritime missile defense.¹⁸

Forces in the air have speed and some flexibility in tactics to ensure their own survival. Air forces have smaller platforms but operate in the same medium as the weapons that are likely to attack them. As such, air forces can use speed to survive many challenges. Aircraft speeds are now constrained by the physical limitations of human pilots. The evolution of missile systems will continue, and unmanned platforms will continue to push the cost of protecting piloted aircraft higher. Today's aircraft require expensive technological superiority to defeat missiles of superior speed. Still, the viability of air forces relies to some degree on their ability to "hide" in the sky from ground based air defenses. Line of sight, (LOS) refers to direct observation of an intended target, kinetic energy weapons will only become more deadly at greater ranges without stealth. The utility of speed as a defense declines as missiles grow faster and missile defense systems develop. Ultimately the inevitability of aircraft losses should bring fewer manned and more unmanned aircraft. Remotely piloted aircraft can exceed the stresses that pilots can endure. Capabilities for greater survival are possible. Alternatively, they could be made more cheaply in greater numbers to offset likely losses. Unmanned and remotely piloted aircraft are likely to become more important over time.

The line of sight problem is least felt on the ground, where forces can disperse or use terrain, weather, populations, and other ground-based complexities to their advantage. They can also directly attack aerial and other platforms in ways that force their attackers to be more remote and less effective. The combination of ground and tactical air forces creates a synergy that denies opponents the countermeasures that would be most effective against ground or air forces separately. Tactical ground and air forces, combined with strategic lift, provides global reach for strategic purposes. Again, it is clear that a combination of ground and tactical air forces are likely to provide the greatest increase in joint force capability for the amount of resources invested. This is not likely to change in the future, where further advances in technology could include smarter hypervelocity missiles and electromagnetic guns. This variety of systems would degrade survivability in the same relative order of sea, air, and land.

The Folly of pursuing Victory from the Sky

Some observers of the trends in military technology foresee a future in which air forces conquer air defenses and the ground becomes untenable. The previous example of the Navy illustrates the difficulty of conquering all ground-based defenses. The highly improbable forecast for overwhelming lethality is based on massed armor formations moving in desert terrain. This is a classic case of preparing for the last war. To completely dominate ground forces from the air is impractical, if not impossible. To produce a decisive, independent air arm would require airborne systems with extreme size and weight constraints to outperform air defense systems that are not burdened by similar constraints, not required to sustain G-forces, and not required to travel at speeds above Mach 1. The pursuit is impractical and expensive, if not impossible.

If air forces were to pursue this advantage they would follow the example of Naval forces in dedicating more resources to self-protection and fewer to achieving decision. Current stealth aircraft are effective at evading radars originally designed to track commercial aircraft. How much more will it cost to evade radars designed to detect stealth aircraft? This trend in higher spending patterns is already evident, but how far should it go? Recent reports by the Office of the Secretary of Defense and Senator Warner advised the Senate Armed Services Committee that the F-22 will cost 15 billion dollars (30%) more than the forecast are one indication.¹⁹ US News and World Report cites that US plans for investment in tactical aviation are estimated at anywhere between \$335 and \$445 billion.²⁰

Most advocates of an independent air arm base their claims on the hyperbole of the "air war" in Operation Desert Storm rather than from the ongoing deflation of those claims. Many are not aware, or refuse to acknowledge, that Iraqi guns dominated airspace below ten thousand feet in the Gulf War. Coalition pilots were generally restricted from flying below that altitude to avoid the simple but effective anti-aircraft guns. Their remoteness from ground targets produced the gross discrepancy between reported and actual destruction. Indeed, pilot reports after thirty-eight days of bombardment accounted for the destruction of many more vehicles than anyone believed even at the time.

To make sense of pilot reports from the twenty-three thousand aircraft attacks on ground forces, staff officers counted all photographic confirmations of destroyed vehicles, half of the pilot kills by supporting videotape, and one-third of reported pilot kills without benefit of video.²¹ Using that calculus, it is easy to see how actual pilot reports claimed to have destroyed 80-100 percent of the Iraqi equipment thought to be in

Kuwait by the end of 38 days of the air campaign. At that point, after Gen. Schwartzkopf's staff conservatively estimated 50 percent destruction had been achieved, and he ordered the ground attack. Two years later, studies estimated that actual destruction was closer to 25 percent. Current studies by others cite even lower estimates. For example Robert Pape cites studies by Army, Marines and CIA which estimate that about 20% of Iraqi equipment had been hit from the air during both the air and the ground campaigns. It was impossible for them to differentiate which damage was caused by independent air attack.²² The simplest assessment came in the conclusions of from the Evaluation of the Air War by the General Accounting Office: "...Lastly, many of DoD's and manufacturer's post war claims about weapon system performance -- particularly the F-117, TLAM, and laser guided bombs -- were overstated, misleading, inconsistent with the best available data, or unverifiable."²³ Then Secretary of the Navy John Dalton reported to the Senate Armed Services Committee in March of 1996 that Tomahawk cruise missiles performed up to standard less than 60% of the time.²⁴ The truth may not be clear even after all the war data is declassified. Saddam Hussein's military adventures since the Gulf War support assessments that the Iraqi Army was not as devastated as reported just a few years ago.

The downward revisions of the damage done by air attacks are consistent with reports from ground observers. Ground troops generally reported extensive damage to fixed sites, but little evidence of damage to ground forces. Captured Iraqi soldiers told of repeatedly luring aircraft to shoot at decoys. When targeted, they reported burning stacks of tires next to their vehicles. The apparent destruction reportedly caused aircraft to break off their attack.²⁵ Even the spectacle of the vaunted mile of death appears to have been inaccurately portrayed, with air attacks causing a minor contribution to the destruction. Eyewitnesses of the vaunted "mile of death", including the author of this paper, estimate Iraqi casualties from air bombardment at less than 50 people and attribute most of the damage shown in the popular press to ground combat and road clearing efforts by US forces.²⁶

Unlike the case in previous wars, battle damage assessment in Kuwait included immediate press coverage of pilot debriefing and the absence of timely ground verification. Years of lag time for academic analysis of air achievements means long lag times between claims and verification. Indeed, many claims simply cannot be verified. In the final analysis, pilots in the Gulf War may have overestimated their effectiveness by a factor of nearly ten, or roughly the same as in World War II.²⁷ Future force structure decisions based on such inaccurate data and misinformed popular perceptions would be

dangerous and irresponsible.

Conversely, the battles between Iraqi air defenses and American warplanes are instructive. Current reports are again dramatically different from the hyperbole of Gulf War reporting. As stated earlier, Iraqi ground-based radar tracked US Air Force F117 fighters over Baghdad, but Iraqi fighters sent to intercept them could not.²⁸ The space and weight limitations of operational aircraft make their radars less capable than larger ground-based systems, which are naturally more sophisticated, and apparently, survivable. Recent estimates show that 5,335 air strikes against the Iraqi integrated air defense system did not destroy it, as reported in 1991. The system needed only to be disabled to achieve US war aims at the time, and complete destruction would have consumed far more resources.²⁹ The Gulf War experience is consistent with historical patterns of inflated claims and deflated realities of air power's independent accomplishments.

Recent efforts to reduce Iraqi air defense capabilities in southern Iraq illustrate the trend in the cost of US force employed versus the damage inflicted when pursuing remote victory. "Iraq rebuilt a surface-to-air missile network in southern Iraq last month within two weeks after the United States launched more than \$50 million worth of cruise missiles to destroy it, a senior defense official acknowledged in a recent interview."³⁰ Despite a declared success, the limited damage to old Soviet systems was repaired within weeks with some simple labor and spare parts. The performance of cruise missiles was reported as mixed.³¹ Policy assessments by Henry Kissinger was even more critical of the mismatch of political objectives and military means in the conflict:

The nature of America's military response compounded the problem... Yet when Saddam moved, the administration's military riposte had the feel of an abstract staff study on air strategy. It was unrelated to the area being contested and overlaid with the excruciatingly academic theory of "signaling," drawn from arms control seminars.³²

It is ironic that General Fogelman was quoted as saying that air forces will soon "have the ability to find, fix or track and target anything of significance that is moving or is fixed on the surface of the earth in near real time."³³ During Desert Storm, the theater commander in chief, General Schwartzkopf, designated Iraq's Scud missiles as the top priority target. The first, well-publicized reports of destruction of "up to seven mobile Scud launchers" were quickly determined to be either milk or fuel trucks, but

public misperception was not corrected.³⁴ The Gulf War Air Power Study (GWAPS) analyzed the 2,500 air missions sent to attack Scuds. About 1,000 diverted to other targets. Most of the 1,500 "Scud" strikes were against fixed sites or suspected positions. Only 15% of these air attacks were recorded as attacking the mobile Scud launchers which were doing the damage to Israel and Saudi Arabia. Of the 42 attack "Scud Patrol" aircraft who physically observed a scud launching, only eight were able to identify a target against which to deliver ordnance. Attacking scuds was further complicated by the placement of decoys that UN inspectors found indistinguishable from the real thing at 25 yards. Summarizing the effectiveness of air power against mobile scuds, the GWAPS noted that for F-16E and FLIR equipped F16-L: "...rendered the probability of finding Iraqi mobile launchers extremely low — even when the launch point could be localized in into a relatively small area in near real time by either air crew visual sightings or offboard sensors providing coordinates."³⁵ In other words, even when pilots saw it fire or had a real time sensor sighting, they could not find or destroy the SCUD. Indeed, UN inspection teams currently working with the benefit of international intelligence assets, on-site inspections, and six years of air dominance do not believe they have yet discovered all of Iraq's Scuds. UNSCOM's executive chairman told reporters that as of September 1996 that his inspectors' work is incomplete. The inspectors are concerned that 12 extended range, biological weapons capable, mobile SCUD launchers may still be unaccounted for. Only 13 of the 25 known to exist before the war have been accounted for.³⁶ Clearly, if acquisition from the sky becomes easy, at least the discrimination of important things on the ground is more difficult than advertised. That is likely to remain the case.

To pursue the narrow offensive capability provided by air power alone offers an active opponent unlimited opportunity for innovative countermeasures. Whatever our technological ability for remote target discrimination, the human opponent will always find ways to respond. A variety of techniques to interposition combatants and non-combatants will always be available. The "silver bullet" that achieves decisive victory without risk or casualties has not, and will not, be found. The integration of complementary capabilities remains the best approach. Joint air and ground forces will continue to offer the best chance of success for the least cost in dollars and lives. Air forces provide unprecedented freedom of maneuver and attrit key dimensions of an opponent. Ground forces easily sweep away air defenses to allow continued advances and seizure of objectives. Control of the air is absolutely necessary to facilitate decision on the ground, but it is not an end in itself.

Technology and Future Land Forces

The strategic mobility of Army ground forces has increased dramatically despite relatively small resource commitments by the Department of Defense. It is a measure of resource efficiency that the world's eighth-largest army, with less than one-fourth of the US defense budget, has become strategically mobile and is universally recognized as the world's best. Only the US Army is requested by every major country in the world to lend its expertise, routinely operating in more than 70 different countries at any given time.

In examining air and land forces in combination, two things are clear. First, technology enhances established strengths in both types of forces by affording self-sustaining forces with greater combat effectiveness in platforms and ordnance. Second, new technologies overcome previous limitations with synergistic increases in transport capability and reduced mass. While emerging technologies will create new vulnerabilities for both land and air forces, the effective combination of these forces assures that new strengths will overcome new weaknesses. The result should be a steadily increasing ability to project decisive power quickly. However, this is not necessarily the case for naval and marine forces.

The Army's increased mobility has not escaped the notice of the US Marine Corps. Gen. Krulak, the commandant of the Marine Corps, told Marines stationed in Okinawa, "The Army's prepositioning afloat can beat us to the Gulf by two days."³⁷ He did not mention that inland prepositioning allowed an Army brigade to be combat ready in Kuwait in 96 hours -- a time Marines can reach only by starting on station. (To keep one set of Marines on station requires three sets in the force structure.) Gen. Krulak's comments were meant to exhort his troops, but they should exhort policy makers as well. Why spend limited resources to increase the responsiveness of temporal amphibious capabilities to a level less than what Army forces already achieve? The decisive capability is already more responsive and cheaper.

The invasion of Panama provides another example of the Marines' lack of responsiveness. When the Joint Chiefs were discussing their options for the Operation Plan called Blue Spoon (ultimately executed but thankfully renamed), the Marine commandant offered that he had an expeditionary unit fully trained and embarked that could be there within days. The forces were not considered because they were not appropriate and could not arrive in time to contribute to the mission. "Panama was a

classic candidate for a Marine Landing; it was a small country, virtually all coastline. But Blue Spoon was an almost exclusively Army Operation. Surprise and speed dictated an airborne operation. Marines transported on ships often took too long to arrive; and their presence enroute or offshore was difficult to hide."³⁸ Today, responsiveness is measured in hours and marines are still tied to shipping speeds. The service's own development efforts are focused on the vertical take off and landing aircraft, (V-22) and other means to extend their operational range from their ships. The current approach of using ships as intermediate staging bases for aerial power projection will undoubtedly achieve greater responsiveness, but the cost will be unreasonable at a time when land-based air power no longer requires such intermediate staging platforms. Projecting US land forces from their existing bases to worldwide destinations in hours requires far fewer forces and resources. Marine forces could be integrated into such a response regime in the future.

Marine Corps enhancements to power projection rely heavily on the Vertical Take Off and landing V-22. This may overcome some of the inherent limitations of sea forces, but they remain organizationally and economically inefficient. Gen. Frederick J. Kroesen's analysis shows Marine forces cost 25% more than Army forces in operations and maintenance costs alone.³⁹ Marine force structure remains tied to maritime mobility for its logistics and projection. When days or weeks of response time was sufficient, forces could preposition in a half dozen key areas and be assured of adequate response. When desired response time is reduced from weeks to hours, maritime projection is no longer viable. Achieving adequate response times would require a tenfold increase in prepositioning or force structure, or a near-perfect ability to forecast crises weeks in advance.

With more expensive, less responsive, and less capable forces, the question of future Marine requirements is indeed a serious one. Such forces provide great flexibility, but the requirement for them is significantly reduced if cheaper, more mobile, and more decisive forces are available. The development of joint Air Force-Army expeditionary forces will provide such increased capability and reduced cost. Marine forces currently remain tied to ships, reducing their utility and responsiveness while increasing their vulnerability and cost. The only long-term answer is to change their mode of transportation. Marines are, in fact, moving in this direction. In the meantime, there is little argument for maintaining more structure than is absolutely necessary. That requirement will decline or change to air transported marines over time.

Effects of Technology on Naval Forces.

The trends toward increased lethality, range, dispersion and smaller formations have mixed implications for naval projection forces. While technology will make naval forces more capable, most future investment will go toward offsetting the increasing vulnerability of large, slow platforms and formations. The inherent limiting factor of naval formations derives from the immutable nature of the seas. Seaworthy surface craft require bulk, and steaming speeds are limited. Neither of these characteristics are likely to be affected by technology, which offers significant potential for destroying ships while offering little to reduce their vulnerability. This was illustrated in the Falklands War, where the poorly armed Argentines with only five Exocet anti-ship missiles sank two British ships and damaged a third.

Ensuring survivability of U.S. Naval surface forces will require continuous fielding of every successive technological innovation in advance of all others. An opponent need only wait for a single US failure to do so. Such an approach cedes initiative and demands extraordinary resources to assure continued viability of surface warfare ships. It creates a kind of technology addiction — like the computer user who simply has to have every hardware and software upgrade (in this case the Navy must actually create each successive upgrade first). An example that applies to both naval and air forces is useful here. After the downing of Capt. Scott O'Grady in Bosnia, the airborne self-protection jammer was fielded to pilots in the Balkans. Within months, the GAO published a report on its effectiveness. The report said that the jammer would have been effective in countering the air defense missile that shot down Captain O'Grady, but would be insufficient protection against other only slightly better missile systems which was also in use in Serbia. The device had been under development and was rushed to Bosnia after the incident. Unfortunately, dealing with even Serbian radars demanded further advances in defensive measures.⁴⁰

The evolution of the CVBG is another example. The aircraft carrier has extensive defenses. Some analysts contend that as much as half of a carrier's air power is devoted to self-defense, to say nothing of the ships deployed around it.⁴¹ Investment in Naval platform enhancement will increase naval forces' lethality and effectiveness, and may assure their survivability. Recent history supports this analysis. Trends in technology, however, assure that investment in naval platform enhancement cannot yield the same returns afforded by investment in air/land power projection forces or in strategic air lift.

It is clear that sustaining viable naval forces will require increasing rates of

investment to achieve declining defense capability. Historical data support the trend if not the exact number. During Operation Desert Storm, naval aircraft generated well less than their share of offensive combat power. The six aircraft carriers in the Gulf carried about 25 percent of the combat aircraft in Kuwait but accounted for only 7 percent of combat missions flown.⁴² The pursuit of this goal provides some insight into why one-third of U.S. defense spending goes toward sustaining the current CVBG-centered Naval force. Indeed, recent analysis by the Congressional Budget Office indicates that projected costs for future Naval systems may be significantly underestimated.⁴³ Thus the logical approach for future spending is to reduce investment in naval expeditionary forces and increase the investment in land and air force combinations, especially to increase expeditionary capabilities. At the same time, the number and potency of alternative weapons are significantly increased. Naval capability should be maintained at the minimum level required to compensate for shortfalls in the power projection capability of air and land forces or shortfalls in strategic air lift. Funds should be invested to remedy shortfalls that exist, rather than attempting to sustain the surface fleet.

The contemporary application of technology by different service branches offers the best evidence of this conclusion. The Navy has been shifting its lethality to air and missile systems for decades, to the point where surface and submarine vessels are little more than launching platforms for aerial systems. Clearly, the best way to increase the lethality and tempo of naval operations is to fly. Unfortunately, technology has provided even the simplest of foes a variety of effective tools with which to attack platforms whose speed cannot be improved and whose bulk cannot be reduced; thus a significant portion of the Carrier Battle Group's combat power must be dedicated to self-protection. These developments constitute what one analyst called, "the self-licking ice cream cone." Resources applied to sustaining the viability of platforms that can never be decisive are better applied elsewhere. A recent analysis by Andrew Krepinevich of Center for Strategic Budgetary Analysis (CSBA) in addition to documenting increasing costs cited two trends for carrier forces: "...first, carriers are becoming increasingly vulnerable, a trend that is not easily (or cheaply) reversed. Second, there are a significant and likely growing number of alternatives to the carrier for providing prompt strike capabilities and conducting forward presence missions."⁴⁴ Krepinevich does not advocate abandoning carriers but, rather, making a transition from the current heavy reliance on carriers for strike operations to a different kind of navy.

Noted British historian John Keegan came to a more sweeping conclusion in his

exhaustive study of the history of Naval conflict, The Price of Admiralty. His concluding chapter, entitled: "An Empty Ocean," offers this stark scenario: "In a future war the oceans might appear empty again, swept of both the commercial traffic and of the navies which have so long sought to protect it against predators."⁴⁵ Keegan goes on to say that the future of navies is below the water's surface, driven there by the need to escape detection and destruction. His bold prediction for the long-term future of naval warfare should inform us in our current defense investment considerations. Resources spent to forestall inevitable trends are not as beneficial as those devoted to exploiting the same trends.

This is not to say that naval platforms will not be required for a variety of missions (such as sea control and sea lift) over the coming years or even decades. Nor does it mean drastic short-term changes to defense spending and planning programs are necessary. Rather, it argues for a reasoned transition in investment spending and structure planning away from surface naval forces and toward a better balance of air, land, and sea forces.

The Real Problem

There are many reasons for the current imbalance. The constitution empowers the Congress to "maintain a Navy and to raise an Army." America's deeply ingrained self-image is that of an island nation protected by its Navy.⁴⁶ The new realities of technology's fundamental impact on the nation's defense are hard to grasp.

The oceans, in fact, provide scant protection in the new security order where dozens of countries possess ballistic missiles and regional phenomena have global implications. At present thirty-five non-NATO countries have ballistic missiles, and eighteen of those have the capability of installing chemical, biological, or nuclear warheads. Further, seventy countries have cruise missiles that are more limited but much less expensive. While most are short-range anti-ship missiles, India is producing a missile with a range of 350 miles, and China, Iran, North Korea and others have similar systems.⁴⁷ Even as the United Nations monitors Iraq's weapons program, the country is developing a missile system with a range of 900 miles.⁴⁸ Little known is the fact that when Chinese missiles were fired in demonstrations in the Straits of Taiwan, US Navy ships did track the missiles but did not have the level of sophistication required to intercept the Chinese missiles.⁴⁹ Dealing with potential adversaries with first world

resources carries serious implications for the current approaches to defense. China has its own list of military capabilities which will distinguish it as a great power in the 21st century including "...a capacity for space dominance, (including anti-satellite capability), air defense lasers and other directed energy weapons, counter-stealth air defense systems, stealthy naval forces, and a capability for conducting offensive information warfare to blind and confuse an opponent."⁵⁰ Note the absence of a pursuit of the kind of Naval or air Forces the US now possesses in favor of forces which may offer ways to cheaply offset US advantages. Technological advances offer a host of options for countries to pursue asymmetric strategies.

These trends in technology have grave consequences for all service branches, but the consequences are the gravest for surface ships. As ranges increase, warships must either develop and field 100 percent of their countermeasures at great expense or be pushed out to sea and out of strategic relevance. Clearly, the current effort is to sustain countermeasures, but that is probably not the most efficient or effective strategy.

The continuing allocation of a full third of defense resources to sustain the only surface Navy of consequence in the world illustrates how difficult it is to break with the past. But efficient use of defense resources depends on our spending against the new realities, not the comfortable past, the elusive present, or the prevailing domestic political winds. Such a transition would meet considerable political resistance, as do most changes in status quo. Current plans for investment in strategic bombers, aircraft carriers and the Seawolf submarine are instructive of the problem. Naval platforms in particular promise money and jobs in many congressional districts.

The current Nimitz-class carrier will bring \$2 billion to about 4,000 contractors in 43 states.⁵¹ Recent cost estimates of the Navy's next aircraft carrier range as high as \$5 billion. While the domestic political returns on such spending may seem high, the security achieved for invested funds is, in fact, low. The implacable forces behind such spending are not new. Dwight D. Eisenhower used his farewell to the nation to warn of "the military-industrial complex." He was disturbed by his inability as commander-in-chief to direct defense spending in ways that seemed clearly in the nation's interest. More recently, Senator John McCain complained in an editorial about the amount of pork in the 1996 Defense Appropriations Bill. His comments addressed the implacable tendency to spend money on huge programs of dubious value to the nation's defense:

There are a great many functions of the defense budget which were they strengthened, would substantially contribute to our defense against these threats. But

only in the most absurd improvisation of their original mission could the B-2 bomber and the Seawolf submarine be considered among them.

Yet the 1996 defense bill included \$1.2 billion for these exorbitantly expensive and military unnecessary relics of the cold war. House and Senate appropriators propose spending almost \$36 billion for additional B-2s over the next 20 years. The Joint Chiefs of Staff and all our regional commanders argued against further procurement of the B-2, recognizing that this costly weapons system serves only to divert funds from our critical modernization requirements as age and obsolescence force the services to begin replacing trucks, tanks, aircraft and ships in large numbers.

The third Seawolf will eventually cost the taxpayers \$2.4 Billion. Lacking any mission to justify its cost, the Seawolf is really nothing more than a jobs program. The billions of defense dollars it absorbs to meet the political imperatives of its supporters come, again, at the expense of urgent defense priorities. Thus, paradoxically, the Seawolf and the B-2 render the country not more secure but less so.⁵²

The likelihood America's aversion to casualties and "foreign entanglements" also has deep roots and explains much of the nation's current fascination with air power and the vain hopes for it to become the decisive element in conflict. Since 1940, advocates of an independent air strategy have offered a seductive promise to achieve security aims without risk and without casualties. But as Robert Pape's exhaustive study concluded:

Air power is becoming increasingly important in American grand strategy. It projects force more rapidly and with less risk of life than land power and more formidably than naval power. These are valuable attributes for unpredictable crises that occur in places where the American public is not willing to shed much blood. Thus from Iraq to Bosnia to North Korea, increasingly the first question in debates over American intervention is becoming "Can air power alone do the job? The answer is no. First, coercion is hard. It hardly ever succeeds by raising costs and risks to civilians. When coercion does work, it is by denying the opponent the ability to achieve its goals on the battle field."⁵³

Denying an enemy his objectives on the battlefield simply can not be done by air power alone. In the long term, technology further enhances the decisive nature of air-land forces. Lethality increases offer opportunities for massing fires with greater dispersion of forces and greater stealth. Other technologies offer increased fuel efficiency, reduced logistics, and a host of other innovations. Such applications of technology reduce the limitations in strategic mobility while increasing force capability. Naval projection forces, on the other hand, become more vulnerable to a host of proliferating threats and are forced to apply technology to reduce their vulnerability. The benefits of technology are thus consumed without direct contribution to the decisive achievement of US objectives.

Sustaining these forces against the trends in lethality and operational tempo will require accelerated spending with steadily declining utility. Maintaining the viability of such systems will require the US to remain generations ahead of all other actors in fielded technology. In an era of accelerating technological innovation, shrinking product cycles, and rapid technological diffusion and proliferation, the task may ultimately prove impossible. Efforts to dominate the land from the sky alone are likely to fail at high cost as well. The pursuit of such a strategy is inefficient, and the cost will be astronomical. Further, if the manned aircraft become "senile," as Friedman suggests, it will become clear that the extensive spending on them was wasted when they fail in conflict. Perhaps September of 1996 in Iraq was a harbinger of future failure.

What to Do

Now is the time to take the long view and reduce investment in maritime forces, whose capabilities are increasingly limited and anachronistic, while enhancing the forces of decision in future wars. With the current state of technology, strategic bombing forces and maritime forces face declining utility and increasing cost over time. Both will require heavy investment to ensure that the platforms designed to achieve those missions are survivable against increasingly effective and inexpensive countermeasures. Further, many of their tasks are performed at least as well and at less cost by other systems. Sea control will be economically performed by overhead observation and missile destruction. This will ultimately lead, as Keegan noted, to denial of the seas rather than control of them, and to greater reliance on air mobility.

Attack by strategic bombing is costly and ineffective. "Nevertheless, despite its ineffectiveness, it is likely to persist because of bureaucratic interests and political pressures for cheap solutions to difficult foreign policy problems."⁵⁴ Tactical theater air forces can do everything of importance cheaper and better than strategic bombers. But even the use of tactical air systems will be prohibitively expensive and ineffective without the balance provided by ground forces and space-based assets. The very balance of the force makes it efficient and effective in the future. That balance should shift toward tactical land and air forces and strategic air lift. It should shift away from strategic bombing and surface maritime forces.

The advent of the Quadrennial Defense Review and the National Defense Panel offer an opportunity for logic to triumph. Let us hope that the panel's vision of the future

brings the best return on defense investment and the most capable combination for the nation's force structure. Moderate reallocation of resources could accelerate the current trend toward strategically mobile and decisive land and air forces. This would achieve capability for the US military to win wars to project American power. All this could be done without increasing the total resources required for defense if we are willing to make tough decisions.

Jim Warner is an LTC in the US Army

The views expressed in this article are those of the author and do not necessarily reflect the official position or policy of the Department of the Army, the Department of Defense, or the U.S. Government.

¹ See David Ochmanek, "Time to Restructure U.S. Defense Forces," *Issues in Science and Technology*, 35, including "...The brunt of short-term restructuring should occur in the Army's armored and mechanized divisions."; Erlich and Holzer, "QDR turns to troop cuts to afford weapons," *Defense News*, "The Army, with the smallest modernization budget and the largest force structure (endstrength) has the most to lose in a swap of men for machinery."; John Mintz, "The Next Big Military Maneuver: Protecting the Budgets," *Washington Post*, 3 December 1996. 'The conventional wisdom is that the Army is the most likely to take a hit in the review and the Air Force least likely.'; George Wilson, "Pentagon to Delay Weapons Modernization," *Navy Times*, 2 December 1996, p.66. '...But the pentagon's struggle to find money for modernization assures that the budget axe will keep swinging, with the Army's end strength at the center of the chopping block.'; Tom Ricks, "Armed Forces Prepare to Battle One Another for Funds," *Wall Street Journal*, 6 February 1997. 'The likely loser in this argument is the Army...puts the Army squarely in the cross hairs of future defense budget cuts. ... Newt Gingrich and John Kasich are both fans of high tech approaches to restructuring the military that essentially substitutes capital for labor — for example, instead of using thousands of infantrymen to take ground, using a few dozen as forward spotters for long range precision guided missiles. See also Former US Secretary of Defense Perry's response to Senate Armed Services Committee, March 96, "...we have again been criticized on the one hand for having too much money in TAC AIR and on the other hand not enough money in some of these land equipments. But I would point out to you that a key to success of our land battle is maintaining air dominance..."

² Thomas A. Keaney and Elliot A Cohen, *Gulf War Air Power Survey (GWAPS)* (Washington, DC: US Government Printing Office, 1993).

³ See Douglas MacGregor, *Breaking the Phalanx: A New Design for Landpower in the 21st Century*, (Westport, Connecticut: Praeger, 1997). for an example of how ground forces could be reorganized to dominate a technologically advanced war.

⁴ BG Ronald T. Kadish, Leadership Message, Air Force Update, (Washington DC, October 1994.)

⁵ Donald B. Rice, *The Air Force and U.S. National Security: Global Reach -- Global Power*. (Washington DC, Department of the Air Force, 1991).

⁶ Robert Pape, *Bombing to Win*, (Ithaca New York, Cornell University press, 1996) p.326.

⁷ Vago Muradian, "Interviewing Air Force MG Kenneth Israel," *Defense Daily*, 11 February 1997 p.214.

⁸ IBID.

⁹ "Secret Fund Said to total 13.7 Billion," *Jane's Defense Weekly*, 9 October 1996.

¹⁰ George Wilson, "New technology: No place to hide," *Army Times*, December 9, 1996, p. 54.

¹¹ Dana Priest and Tom Kenworthy, "Pilots Believe Lost Attack Jet Has Been Found," *The Washington Post*, April 21, 1997, p. 1. Rowan Scarborough, High-tech hide-and-seek. *The Washington Times*, April 17, 1997, p. 1.

¹² Defense News. -- Congressional Record, Hearings on funding for stealth technology October 1996XXXX

¹³ George and Meredith Friedman, *The Future of War, Power, Technology, and American World Dominance in the 21st Century*, (New York, Crown Publishing, 1996), p.24.

¹⁴ Ibid., p.24. See the Friedman's discussion of the cycle of senility in weapons systems. She outlines the cycle "...It begins with the simple purity of the offensive and culminates in a weapons system overwhelmed by its own defensive measures. In the end the effort required to defend the weapon dwarfs the weapon's offensive power. p.24.

¹⁵ Ibid., p. 25.

¹⁶ Ibid., pp.26-27.

¹⁷ Ibid., p.26.

¹⁸ Frank Gaffney, "The Aegis Option for Defense", *Washington Times*, 4 February 1996, p.16.

¹⁹ Bryan Bender and Tom Breen, "Cohen Says He will Trim F-22 Program if Cost Increase," *Defense Daily*, 4 April 1997, p. 25. A study by the Office of the Secretary of Defense (OSD) is predicting that the cost of the 438 aircraft will be at least \$64.4 billion. Phillip Finnegan and George Seffers, "Lawmakers Plan F-22 attack," *Defense News*, March 3-9, p.1. reports of Sen. Warner advising the Senate Armed Services Committee of projections for cost overruns of \$15 Billion on the F-22. USAF subsequently negotiated for contractors to absorb or prevent the predicted cost over runs.

²⁰ Rick Newman, "Where's the Target?," *US News and World Report*, 7 October 1996, p.46, citing Congressional Budget Office estimates of \$335 Billion; See also Mark Thompson, "The Sky's the Limit," *Time*, 24 March 1997, p.52. for estimate of \$445 Billion for future tactical aircraft.

²¹ See Rick Atkinson, *Crusade, The Untold Story of the Persian Gulf War*. (New York: Houghton Mifflin, 1993), pp.235-236 for a description of BDA reporting and assessment where planners counted 100% of kills verified by U-2 photo, 33% of A-10 pilot reports, 50% of gun camera recorded kills in their effort to track progress toward the CINC's goal of 50% attrition of ground forces.,

²² See Pape, *Bombing to Win*, p.249, for a discussion of Army, Marine and CIA estimates that about 20% of Iraqi forces had been hit from the air during both air and ground campaigns. It was impossible for them to differentiate when the damage occurred.

²³ US General Accounting Office, "Operation Desert Storm: Evaluation of the Air War", July 1996, (Washington, DC: GPO, 1996), pp.4-5.

²⁴ "Navy Says fewer than 60% of Tomahawks were successful in Gulf War." *Inside the Navy*, March 18, 1996, p.4.

²⁵ See Tim Weiner, "Smart Weapons Were Overrated, Study Concludes" *New York Times*, 9 July 1996 and GAO, *Operation Desert Storm*, pp.4-5.

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- ²⁶ Robert Williams and Doug Tystad. *Army Times* great land battles, With eyewitness accounts of members of 3-67 Armor, among the Americans to arrive at Al Mutlaa police station as Allied bombing ceased Armor including the author, Robert Williams and Doug Tystad.
- ²⁷ Dr. Alfred Price, *Spearhead for Blitzkrieg*, (CITY: Greenhill Books, YEAR), p.15. See for estimation of pilot assessment accuracy at about 7%. Footnotes for original Government documents are found in pages 139-149.
- ²⁸ Congressional Record, Hearings on funding for stealth technology.
- ²⁹ Bradley Graham, "Gulf War Left Iraqi Air Defense Beaten, Not Bowed," *Washington Post*, 6 September 1996, A28.
- ³⁰ Dana Priest, "Iraq Rebuilt Missile System After US Attacks, Official Says," *Washington Post*, 15 October YEAR, A12. See also Robin Wright, "US Now Wages War of Nerves Against Iraq," *Los Angeles Times*, 23 September 1996, p.4, for a cost estimate of \$3 Million a day, and Lawrence Korb, "Holding the Bag in the Gulf," *New York Times*, 18 September 1996, 21. Korb cites Michael O'Hanlon of Brookings Institute estimate that the US spends \$50 Billion a year sustaining forces to protect the Gulf. This is the area where the US has most heavily substituted air and naval power over land forces with predictable cost results.
- ³¹ John Mintz, "Cruise Missiles get Mixed Report Card," *Washington Post*, 7 September 1996, A17.
- ³² Henry Kissinger, "No Objective, No Will," *Washington Post*, 10 October 1996. See also, Paul Wolfowitz, "Clinton's Bay of Pigs," *Wall Street Journal*, 27 September 1996, 1/18.
- ³³ George quoting General Ronald R. Fogelman in "Are We on the Verge of a New Arms War?" *Navy Times*, 9 December 1996, p.39.
- ³⁴ Atkinson, *Crusade*, p.232.
- ³⁵ Kearney and Cohen, *GWAPS Summary Report*, pp. 84-87
- ³⁶ Phillip Finnegan, Limited US Action May boost Iraqi Biological Threat, *Defense News*, September, 1996, P.3.
- ³⁷ Jon R. Anderson, "Is Army replacing the Corps as 'quick response' force?" *Navy Times*, 7 October 1996, p.10.
- ³⁸ Bob Woodward, *The Commanders*, (New York: Simon and Schuster, 1991) p.163-4.
- ³⁹ Frederick J. Kroesen, see "Would you really rather have a marine?", *Army*, December 1994 for analysis showing Marine forces cost 25% more than Army forces in operations and maintenance costs alone.
- ⁴⁰ Clifford Kraus, "Radar Jammer is criticized in US study," *New York Times*, 11 Feb, 1997, p. 7.
- ⁴¹ Krepinevich, P.
- ⁴² Kearney and Cohen, *GWAPS Summary Report*, p.184
- ⁴³ General Account Office, *Study on Navy Carrier Battle Groups, the structure and affordability of the future force*, (Washington, DC, GPO, February 1993) p. 19.
- ⁴⁴ Andrew Krepinevich, *A New Navy for a New Era*, (Washington: Center for Strategic and Budgetary Analysis, May, 1996), p. i.
- ⁴⁵ John Keegan, *The Price of Admiralty*, (New York: Viking Press, 1988), p.275.
- ⁴⁶ See Louis Henkin, *Constitutionalism, Democracy, and Foreign Affairs*, (New York: Columbia University Press, 1990) p. 26, for a discussion of the intent of the framers of the constitution including "There was to be no standing Army for

the President to command in time of peace and no Army or Navy at all if the Congress raised or provided it.." While describing the general unwillingness of the Congress to allow presidential direction of armed forces in peacetime, he also notes the higher disdain for a standing Army.

⁴⁷ *The Economist*, Circles of Fear, Jan 4-10, 1997. P.33.

⁴⁸ Jeffrey Smith, UN finds new evidence of Iraqi long range missile research, *Washington Post*, 5 Feb, 1997, P. 20

⁴⁹ Gaffney.

⁵⁰ Thomas Duffy, DoD Study shows Chinese can add military muscle to thwart Naovy Ops, *Inside the Navy*, March 17 1997, p.1.

⁵¹ Eric Rosenberg, "The Press to Ensure A Pro Aircraft Carrier Vote" *Defense Week*, (2 May 1994), p. 2. cited in Krepinevich, *A New Navy for a New Era*, p. 36

⁵² John McCain, Defense Pork, Even a Hawk would Choke on it, in the *Washington Post*, October 26, 1995, P.31.

⁵³ Pape, *Bombing to Win*, p. 314.

⁵⁴ *Ibid.*